NOTES ON THE SCORPION FAUNA OF THE CAPE

PART 3

SOME OBSERVATIONS ON THE DISTRIBUTION AND BIOLOGY OF SCORPIONS ON TABLE MOUNTAIN

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(With 12 figures and 4 tables)

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ABSTRACT

A survey of the scorpion fauna of Table Mountain on the Cape Peninsula was carried out. Four of the six species recorded from this area were found. Distribution and habitat preferences are discussed with reference to topography and vegetation. Some observations on behaviour in the field and laboratory are recorded. A regional key is given.

CONTENTS

INTRODUCTION

Six species in two families of scorpions have been recorded from Table Mountain. *Opisthophthalmus capensis* (Herbst) was recorded by Pocock (1896), Purcell (1899) and Lawrence (1955); *Uroplectes insignis* Pocock by Pocock (1890, 1896), Kraeplin (1894, 1899), Purcell (1901) and Hewitt (1918); *U. lineatus* (Koch) was reported by Purcell (1901) and Kraeplin (1908); *U. variegatus* (Koch) by Pocock (1896) and Hewitt (1918), and *Parabuthus capensis* (Ehrenberg) by Hewitt (1918) and Eastwood (1977*b*). A juvenile specimen from Signal Hill was identified as *U. vittatus* (Thorell) by Penther (1900) but it is very likely that this record pertains to *U. lineatus*. The work on Cape scorpions by early taxonomists was confined to morphological and geographical considerations. With later descriptions of new forms, a reappraisal of scorpion taxonomy has become very complex without the relevant background on ecology and behaviour.

A survey was carried out by regular collecting over a period of one year.

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To complement field observations, live scorpions were kept in the laboratory. Reports are given on diversity and distribution, coexistence, habitats and shelters, and where possible notes are given on behaviour. A regional key was constructed for field or laboratory use.

DESCRIPTION OF THE STUDY AREA

Location

Table Mountain forms the northern end of the mountainous ridge of the Cape Peninsula and lies approximately 33°57′S 18°25′E.

Topography, geology and soils

Table Mountain forms a plateau of Table Mountain Sandstone, which is surrounded by cliffs giving way to gentle slopes. The southern end is deeply dissected by the Disa stream forming the Orangekloof subarea. The sandstone overlies a layer of Malmesbury shale which in turn rests on Cape Granite. The last two formations give rise to the gentle slopes (Moll & Campbell 1976), the areas with which this study is primarily concerned. Soil types are dependent on the parent material, and those derived from the sandstone are usually acidic sands, the granite and shale derived soils contain more clay and are less acidic. The lower slopes are covered with sandstone debris which give rise to soils of mixed origin (Moll & Campbell 1976).

Climate

Table Mountain lies in the Winter Rainfall Region characterized by hot, dry summers and cool, wet winters. The topography plays an important part in the climate. Rainfall for the different subareas are as follows:

Summit and eastern slope	1 420–1 780 mm
Western, northern slopes and Signal Hill	889 mm
Southern subarea	1 227 mm

(from Moll & Campbell 1976)

Temperature differences over the whole area are not as pronounced.

Vegetation

The most extensive plant community is macchia or fynbos, consisting of Proteaceae, Ericaceae, Restionaceae, Geraneaceae and other families. There are also small areas of natural forest communities as well as extensively cultivated alien forest vegetation consisting of *Pinus* spp., *Eucalyptus* spp., and *Acacia* spp. mainly on the eastern slopes and lower northern slopes. There are also areas of *Hakea* sp. on the western slopes. The classification of plant communities is given in Figure 1.

MATERIALS AND METHODS

Six study subareas were defined:

1. North-facing slopes
2. West-facing slopes
3. Southern subarea (Orangekloof)
4. East-facing slopes
5. Plateau subarea
6. Signal Hill subarea

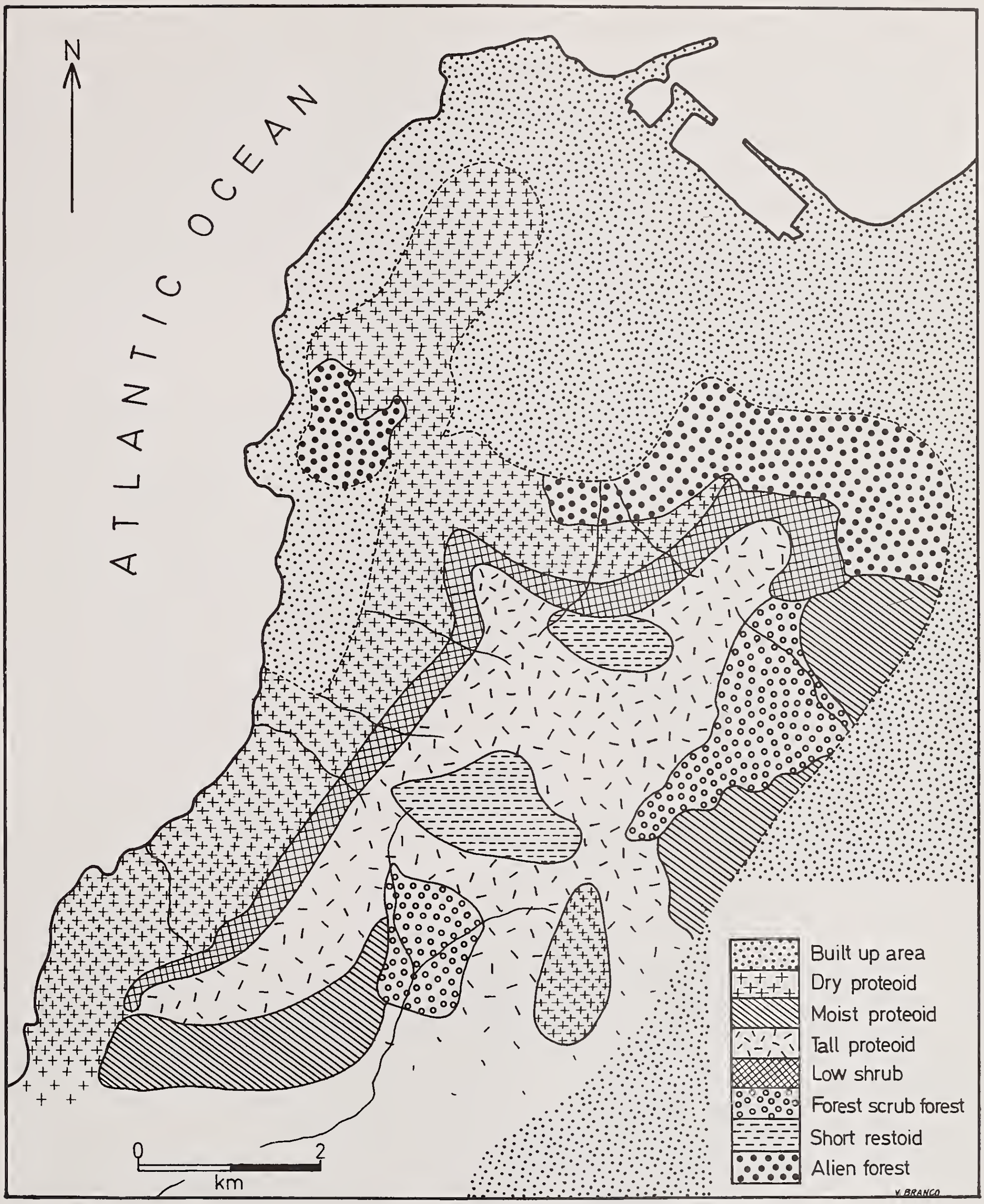

Fig. 1. Map of Table Mountain showing approximate boundaries of plant communities.

Each subarea was divided into a number of transects, 0,5 km wide, extending from the base of the mountain to the sandstone cliffs. The table or plateau was not divided up in this way.

Collecting was carried out by moving up a transect and collecting samples by turning over surface objects such as rocks, logs and other debris, and searching under the loose bark of dead trees. Records were kept of altitude, soil types and vegetation.

Several areas were isolated for the more detailed studies of demes or population aggregates of *Opisthophthalmus* and *Uroplectes*. In these areas burrow morphology, run morphology, feeding and coexistence of species were studied. In order to observe the feeding and burrowing behaviour of *O. capensis*, studies were carried out in the field where possible. In addition a number of specimens were kept in specially prepared boxes in the laboratory to complement field observations of feeding and burrowing. The morphology of burrows was studied by excavation and measurement. The numbers of observed specimens in relation to vegetation types is given in Table 1.

Table 1

Comparison of relative numbers of scorpions observed in each of the six study subareas and seven vegetation types.

Study subarea	Vegetation type	*O. capensis*		*U. lineatus*		*U. insignis*		*U. variegatus*	
		♂	♀	♂	♀	♂	♀	♂	♀
North- and west-facing slopes, and Signal Hill . . .	Dry proteoid	65	27	27	31			5	4
	Low scrub	19	8	21	28				
South-facing slopes and Plateau subareas .	Tall proteoid			12	17				
Plateau subarea .	Short restoid			3					
East-facing slopes subarea . .	Moist proteoid			2	3				
	Forest scrub-forest			9	2	17	28		
North- and east-facing subareas .	Alien forest				1				
Total . .		119		156		45		9	

DISTRIBUTION AND HABITAT

One scorpionid species, viz. *Opisthophthalmus capensis*, was found on Table Mountain, while other recorded species were buthids. *O. capensis* has also been found on the lower-lying Cape Flats and recorded randomly in the Cape Peninsula. This and allied species extend into Namaqualand (Eastwood 1977*a*). Another species, *O. macer* Thorell, extends from False Bay eastwards to Port Elizabeth (Lawrence 1955). *Parabuthus capensis* (Ehrenberg) extends from Clanwilliam in the north to Cape Town, and eastwards to Tulbagh (Eastwood 1977*b*). Another widely distributed species, *P. granulatus* (Hemprich & Ehrenberg), is found on the Cape Flats to the north and has recently been collected in the suburban areas north of the city. *Uroplectes lineatus* is reported by Lawrence (1955) to extend from Cape Town eastwards to Mossel Bay, and northwards as far as Tulbagh and Worcester. *U. insignis* is confined to Table Mountain. *U. variegatus*, another local species, is recorded from the Cape Peninsula and its immediate neighbourhood, and Langebaan in the north (Lawrence 1955).

In the present survey of the Table Mountain study area, *O. capensis* was located all along the west-facing subarea, the Signal Hill subarea and the

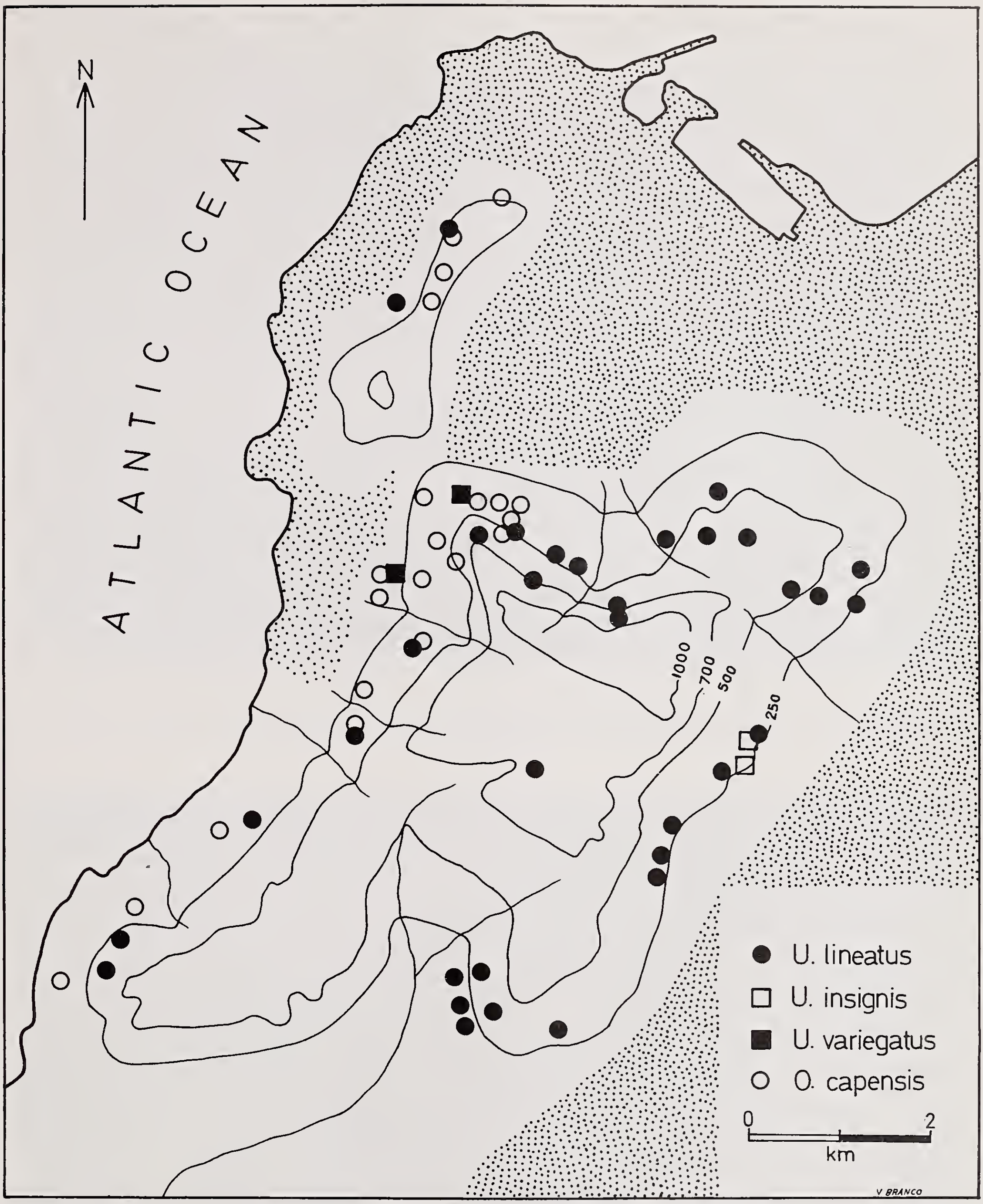

Fig. 2. Map of Table Mountain showing distribution of scorpions collected during the survey.

western extremity of the north-facing subarea. There was a tendency for demes to be found in fairly open areas of the dry proteoid communities, i.e. below the 400 m contour, where the slopes were not too steep and ground cover plentiful, but they also occurred in the low scrub communities where the ground cover and substratum were suitable (Fig. 3).

U. lineatus is the most widely distributed scorpion on Table Mountain (Fig. 2). As well as occupying widely differing habitats it was found in all the

Fig. 3. Typical habitat of *Opisthophthalmus capensis*, *Uroplectes lineatus* and *U. variegatus*. In the foreground is the dry proteoid plant community and further back the low scrub community.

subareas under study, and at varying altitudes where ground cover was adequate. The demes were not as obvious as those of *O. capensis* and in many cases only a few specimens could be found in a large area. This could be accounted for by the immovability of much of the ground cover, or thick scrub and grass, making collection difficult. Thus *U. lineatus* was found in the dry proteoid, low scrub, tall proteoid, moist proteoid, short restoid and forest scrub-forest plant communities. This species appeared to be most abundant in the dry proteoid communities on the north- and west-facing slopes. Only one specimen was found in alien forest. It will adapt to many situations as shown by the range of habitats it occupies, and is often reported to be found in the homes of residents near Table Mountain and even at the 600 and 700 m contours where access for the collector is allowed only by traverses along rocky ledges.

Specimens of *U. variegatus* were found in the same areas as occupied by *O. capensis* in the dry proteoid communities (Fig. 2).

U. insignis is taxonomically very near *U. lineatus*. Purcell (1902) regarded it as a distinct species. He recorded specimens from the Constantia and Newlands slopes of Table Mountain (east-facing subarea). In the present survey two substantial demes were located (Fig. 2). These were situated in the forest and scrub forest communities which dominate the east-facing subarea. Specimens were collected from under stones as well as from under the dried bark of *Pinus pinaster* and *P. radiata* stumps in areas which are being cleared of alien vegetation (Fig. 4).

Fig. 4. Typical habitat of *Uroplectes insignis* and *U. lineatus* in the forest scrub-forest community of the east-facing study subarea.

Fig. 5. Run and burrow of *Opisthophthalmus capensis*. The antechamber is absent in this particular run.

No specimens of *Parabuthus capensis* were found in the present survey. There are several specimens in the collection of the South African Museum collected from Devil's Peak (north-facing subarea) which lies in the dry proteoid community.

SCORPION SHELTERS

Opisthophthalmus capensis was always found to construct its burrow beneath some surface object. The excavation leading from the opening under the stone or log to the burrow entrance is the run. The structure of the run is dependent on the size and shape of the ground cover and nature of the substratum (Fig. 5). Thus the run varies in length and sometimes has two or even three openings. Just before the burrow entrance proper there is usually a bulge or separate section which could be called an 'antechamber' (Fig. 6B). Often food remains are found in this area and its function appears to be a feeding area, and possibly affords freer movement for the scorpion to turn or employ its sting. Excavation of some fifty burrows sometimes revealed food remains in the terminal chamber of the burrow itself. The burrow is usually a simple tunnel having a charac-

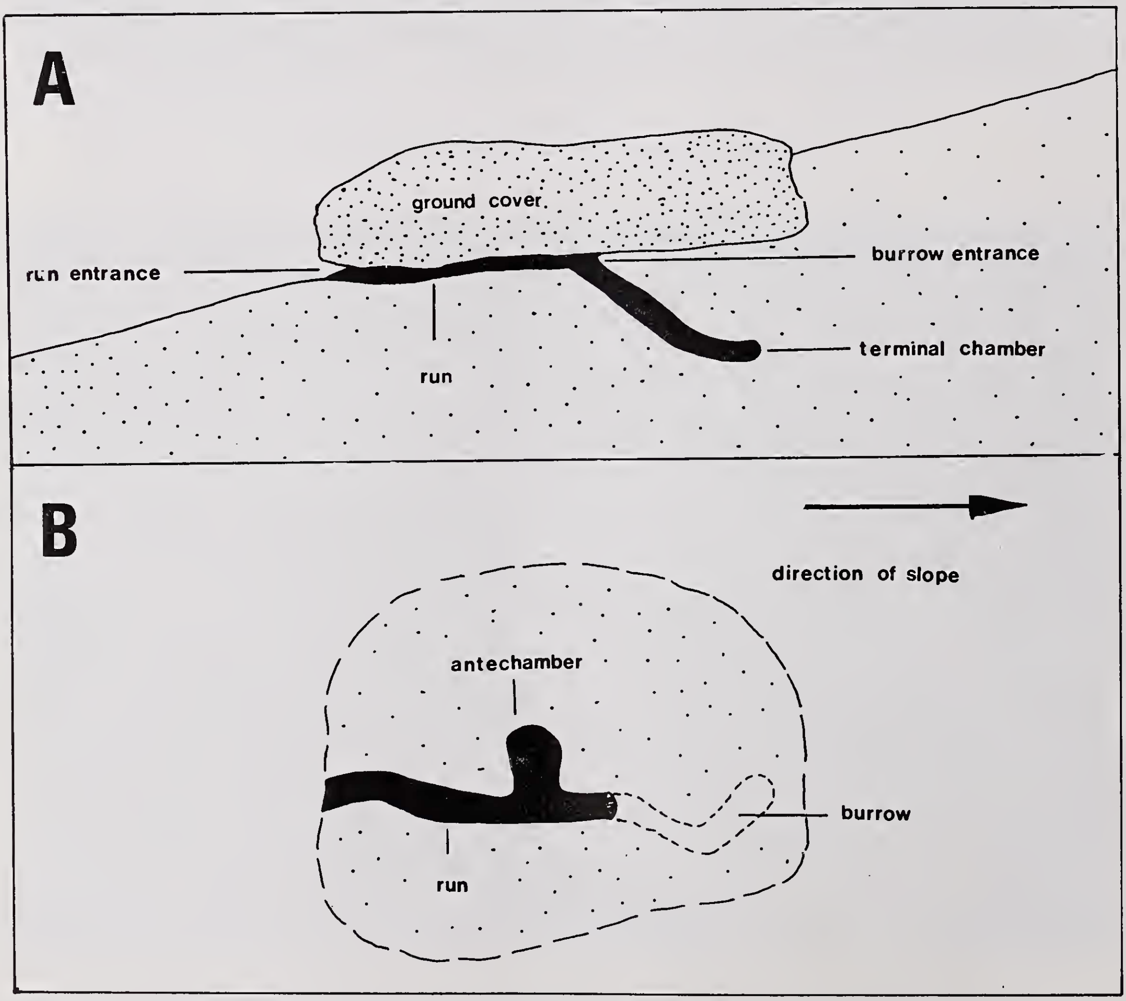

Fig. 6. A. Cross-section. B. Plan of typical run and burrow of *Opisthophthalmus capensis.*

teristically oval entrance penetrating the ground at about 30° from the horizontal (Fig. 6A). It often turns to right or left, if there are obstacles in the way, and ends in a very slightly enlarged terminal chamber. Variation is due to the nature of the substratum, size or sex of the inhabitant. Males construct shallower burrows or none at all, living only in a run. Only one specimen occupies each burrow. Ground cover, usually sandstone debris lying on soils of mixed origin, often sandy loam, under which burrows were found varied from 15 to 60 cm in diameter. If the stones lay on a slope the run entrances always faced downhill, ensuring dry runs during rainy weather. Table 2 gives the measurements of fifty burrows.

TABLE 2

Measurements in centimetres of fifty burrows of *Opisthophthalmus capensis* (36 ♂♂, 14 ♀♀)

	Min.	Max.	Mean
Run length ♂	9,0	27,0	17,2
♀	10,0	22,0	15,3
Run width ♂	2,6	4,0	3,2
♀	2,5	3,4	3,1
Burrow entrance height ♂	1,8	3,1	2,9
♀	2,0	3,6	3,1
Burrow entrance width ♂	2,1	3,2	2,9
♀	2,2	3,0	2,8
Burrow length ♂	0,0	20,0	10,6
♀	10,0	21,0	19,8
Vertical depth of burrows ♂	3,5	6,5	5,2
♀	6,0	13,5	11,1

Uroplectes lineatus occupies a wide range of shelters which may be classified as follows:

1. Beneath suitable stones—no evidence of any run construction, but where concavities form a natural shelter.
2. Beneath stones where a run has been constructed.
3. Beneath debris such as logs and dried organic matter.
4. In rock crevices, or under stones lying on a flat rock surface.
5. Beneath tree bark.

A deme of *U. lineatus* in the south-facing subarea was found suitable for a study of run morphology. The structure of the run is dependent on the nature of both ground cover and substratum (Figs 7–8). The runs vary greatly in length and width (Table 3) and may have one or two entrances.

U. lineatus in the east-facing subarea had the same shelters as *U. insignis*, namely the space between dried bark and stumps of pine trees (Fig. 9), although the two species were not found together under the same cover. Where sandstone

TABLE 3

Measurements in centimetres of thirty runs of *Uroplectes lineatus*.

	Min.	Max.	Mean
Length of run	3,5	16,5	11,3
Width of run	0,8	2,2	1,4
Ground cover size (diameter)	9,0	55,0	31,0

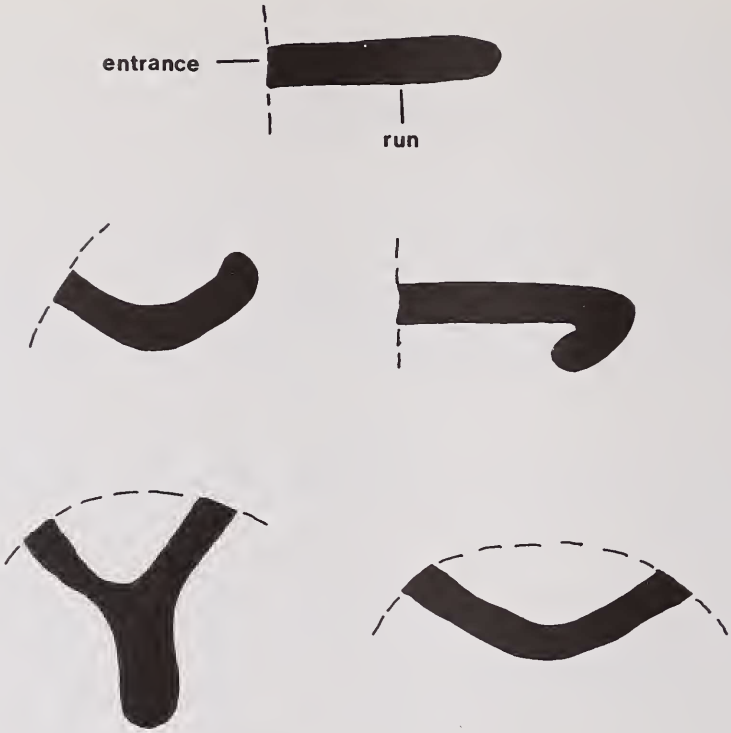

Fig. 7. Diagrams showing variation of runs or scrapes of *Uroplectes lineatus*.

Fig. 8. Run of *Uroplectes lineatus*. Usually the runs are not as well defined as this one.

Fig. 9. A section of bark removed from a pine stump, showing a specimen of *Uroplectes insignis*, several isopods and a longicorn beetle.

debris formed the ground cover, only one specimen of *U. lineatus* or *U. insignis* was found under each stone, whereas up to nine specimens of these species were collected from a single stump. One specimen of *U. lineatus* was found in a shallow, wide burrow in the north-facing subarea and not covered by any surface object. Presumably the burrow was excavated by another animal.

U. variegatus was found to occupy narrow runs, usually well defined with a small terminal chamber. Some specimens were also found in natural depressions beneath stones. Table 4 gives measurements of five runs of *U. variegatus*.

Table 4

Measurements in centimetres of five runs of *Uroplectes variegatus*.

	Min.	Max.	Mean
Length	4,0	13,0	9,4
Width	0,75	1,4	0,92
Ground cover size (diameter)	16,0	48,0	37,0

Parabuthus capensis was not collected during the survey, but has been collected by the author from other parts of the Cape. This species often excavates runs which vary according to the nature of ground cover and substratum and usually consist of a more or less round or oval space beneath the ground cover with one or two entrances.

COEXISTENCE

The following pairs of species were found to coexist: *Opisthophthalmus capensis—Uroplectes lineatus*, *O. capensis—U. variegatus*, *U. lineatus—U. insignis*. In field studies demes or population aggregates were roughly delineated by markers to determine the spatial distribution of their shelters.

Of eight demes of *O. capensis*, five showed a spatial overlap with demes of *U. lineatus* (Fig. 10) in studies carried out in the west-facing subarea. Specimens of *U. variegatus* were recorded in association with *O. capensis* in two of these demes where *U. lineatus* was absent. In one instance a specimen of *U. variegatus* had its run under the same rock as *O. capensis*, their respective entrances opening on opposite sides.

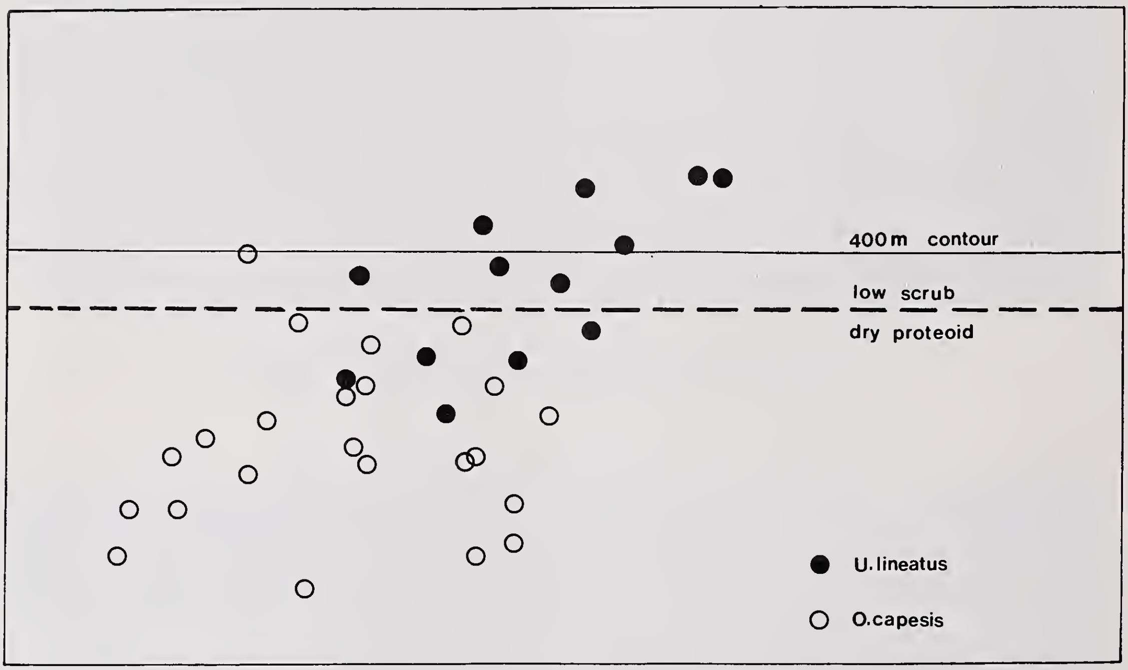

Fig. 10. Diagram of population aggregates of *Opisthophthalmus capensis* and *Uroplectes lineatus* in the west-facing study subarea, showing spatial overlap.

In a study of coexistence of scorpions by Williams (1970) two mechanisms were found to permit coexistence: the choice of different-sized prey, and habitat specialization. The first mechanism undoubtedly operates in the case of *O. capensis—U. lineatus* and *O. capensis—U. variegatus*.

U. insignis and *U. lineatus* were found under the bark of pine stumps in the same immediate vicinity, but specimens of either species did not share the same shelter. The mechanism permitting coexistence in this case is not quite clear.

The record of *Parabuthus capensis* from Devil's Peak indicates the probability of the coexistence of this species with *U. lineatus*. *P. capensis* from the Citrusdal district has been found in association with *U. carinatus* (Pocock) and *O. pallidipes* Koch.

SCORPION PREDATORS

Because of the nocturnal habits of scorpions, predation is not often reported. The author has seen a troop of baboons on the northern slopes of Table Mountain foraging beneath stones. Baboons (*Papio ursinus* (Kerr)) are well-known predators of scorpions. The bokmakierie (*Telophorus zeylonus* (Linn.)) and the fiscal shrike (*Lanius collaris* Linn.) have been reported to prey on *Uroplectes lineatus* (I. G. Taylor pers. comm.). Owls are undoubtedly the commonest predators of scorpions. The spotted Eagle Owl (*Bubo africanus* (Tem.)), a local species, is reported to feed on scorpions (Roberts 1940). The Barn Owl (*Tyto alba* (Scopoli)) feeds on buthids and scorpionids (Vernon 1972).

SOME OBSERVATIONS ON BEHAVIOUR

The behaviour exhibited in burrow construction has been discussed by Williams (1966) for the Neotropical species *Anuroctonus phaeodactylus* (Wood) (Vejovidae), and Newlands (1972) reported on the burrowing behaviour of *Protophthalmus holmi* Lawrence, *Opisthophthalmus concinnus* Newlands and *O. flavescens* Purcell, all Ethiopian Scorpionidae.

An important adaption of *Opisthophthalmus capensis* is its ability to construct burrows. In the laboratory specimens made burrows by loosening tightly-packed soil with a biting action of the chelicerae. The loose sand was then scraped out backwards by legs I and II which were tucked under the body. Legs III and IV provided the traction while the pedipalps were extended anteriorly and acted as supports to prevent the body tipping forward and occasionally as levers which aided in the backward movement. The cauda was extended straight out behind the body. The soil was transported rapidly backward in a single movement and the soil deposited outside the entrance on a tumulus by a slight flick of the first two pairs of legs so that the soil sprayed out. Occasionally the scorpion moved its load of soil by moving backward for a few centimetres, stopping, and thus pulling the soil backward with each step. With each step there was a pause while the hind legs were moved backward again to repeat the process. Thus two methods were employed to transport the soil: the first was used in exceptionally dry soil where backward movement was smooth and unimpeded; the second method was employed when the soil was damp and therefore more difficult to move, or if the burrow was steep or filled with small stones, twigs and similar obstacles. Several specimens did not burrow but made runs under stones provided for this purpose. Initially the animal would remove the soil in the usual manner as well as forming a broad chamber beneath the stone by pushing the soil with the tail. The curved tail was laid flat on the surface and then extended, thus moving a good volume of soil each time. This tail scraping is reported as being a widespread phenomenon among scorpions (Newlands 1972). It is also reported as a part of burrow maintenance in *Anuroctonus phaeodactylus* (Wood) by Williams (1966).

Field observations showed that immature specimens were adept at burrowing. Several second or third instar nymphs were found in burrows of 1–2 cm in length under stones. These burrows rarely had the characteristic oval opening and were often nothing more than shallow depressions.

The tarsi of *O. capensis* are adopted for a pelophilous habitat, that is the claws are sharply curved and tarsal setae are not as dense as in *O. wahlbergi* (Thorell) for example, a psammophilous species. Caudal segment V is heavily sclerotized with numerous setae and well-developed keels to facilitate tail-scraping. Collections made in the field during the winter months (June–September) indicate that these scorpions remained deep in their burrows on cold days, but if the sun was hot they were often found at the entrances of their burrows or in the runs, facing outward. This 'doorkeeping' is presumably maintained while the scorpion waits for prey which may seek refuge under stones (Alexander & Ewer 1958). The tail was curled around sideways, parallel to and resting on the substratum so that the telson, which was folded over the dorsal surface of caudal segment V, lay against the lateral side between the sixth and seventh mesosomal segments. From this position the metasoma could easily be brought into action sideways, as had been observed in the laboratory. This sideways movement is obviously more suitable for stinging prey while the scorpion is in its run. The pedipalps were arranged so that the femora were perpendicular to the body and the tibiae and chelae lay parallel to the body. The movable and immovable fingers were kept about 5 mm apart. If the scorpion was just inside the burrow entrance, the chelae may have protruded and were arranged as above. Sometimes the chelae were folded over each other with the dorsal and outer sections facing outwards, forming a sort of shield. This is a typical defensive stance for Scorpionidae (Newlands 1969). When a stone was lifted while a scorpion was in its run it would lift its tail so that the telson lay above the first caudal segment and the body was lifted off the substratum. If further aggravated it would adopt an aggressive stance so that the last two mesosomal segments were curved upward, the metosoma perpendicular to the ground except for the last caudal segment which was held horizontal with the telson above the last mesosomal segment or carapace. Another reaction was retreat, in which case the cauda was brought down backwards and the animal scuttled down its burrow, either backward or forward.

The function of the doorkeeping seems to be related to feeding, where the scorpion waits for prey to come into the run. At no time was it observed that the scorpion was an active predator. However, active foraging in the vicinity of burrows is known for *Opisthophthalmus* (G. Newlands, pers. comm.). Feeding was observed in the field in the runs or antechambers.

Feeding behaviour has been discussed for Neotropical scorpions by Baerg (1954) and Hadley & Williams (1968) (Buthidae and Vejovidae) and for the South African *Opisthophthalmus latimanus* by Alexander (1972). In the field *O. capensis* was observed feeding on *Dorylinus helvolus* (Formicidae) and *Temnopteryx phalerata* (Blattariae). In the laboratory a wide range of prey species were accepted and eaten, while others were ignored. Prey species which were accepted were *Periplanita americana*, *Temnopteri phalerata* (Blatteriae), *Dorylinus helvolus* (Formicidae), *Holopternia valga* (Hemiptera) as well as *U. lineatus*, isopods, Scarabaeidae, beetle larvae, moths and moth larvae. The following species were either killed or ignored but not eaten: Chilopoda, Diplopoda and *Anthia* spp. (Carabidae).

During excavation of burrows food remains in the form of pellets were sometimes found in the terminal chambers or in the runs. The food remains were identified as small tenebrionid beetles and cockroaches from the indigestible elytras and legs. Thus feeding occurred both in the burrows and the runs. Feeding behaviour was elicited in the laboratory by placing the prey near the scorpion which usually rests in the typical doorkeeping posture. Small prey was firmly grasped in both chelae and the metasoma brought upright. Small prey was not stung and the biting action of the chelicerae began immediately. If the prey was lively but not very large the scorpion brought the telson into play from the side and usually slowly, seeking for a soft spot in which to inject the venom. If the prey was large and aggressive the scorpion initiated offensive behaviour and the telson was brought swiftly over the carapace to deliver a series of stings. The ingestion process lasted from 1 to 3 hours in the laboratory, depending on the size of the prey. The formation of pellets of food remains was not observed. Ingestion started immediately after capture and in heavily sclerotized prey the starting point was ventrally between head and thorax. The chelicerae moved alternately in and out while the fingers grasped at the food, giving rise to the typical biting action.

Sponge-bathing activities were not observed after feeding, nor after burrowing in wet soil when the legs and chelicerae became dirty.

In humid laboratory environments *O. capensis* was never seen to approach the dish of water in the cage and it seems likely that water balance is maintained by contact with a wet substratum as reported by Hadley & Williams (1968) in observations at night of desert scorpions. If the cage was kept very dry and water placed in the cage the scorpions would climb over the edge of the dish and dip the chelicerae and pedipalps into the water. At the same time the pedipalps moved rhythmically up and down.

Uroplectes lineatus adopted a very characteristic resting posture while under ground cover. The pedipalps were usually held so that they lay slightly anterior to or lateral to and subparallel to the carapace. The tail was curved over the abdomen dorsally so that the second caudal segment was horizontal to the body and the terminal segments curved around sideways and the telson lay laterally between mesosomal segments V and VI, being folded over against caudal segment V dorsally. In the defensive posture the tail lay behind the body with the telson curved forward so that it lay above the first caudal segment. When agitated this scorpion can strike very rapidly to the side, forward or backward. This species did not use the chelae to grasp an aggressor but only struck out with the tail. In the aggressive posture there was a slight forward stilting. Venom-dripping was associated with aggressive behaviour. In the laboratory it was noticed that *U. lineatus* was able to excavate a run, but the behaviour of digging was not observed. In the east-facing subarea specimens were found in association with Isopoda, geckos, longicorn beetles, *Lagria villosa* F. (Lagriidae), Pyrrhocoridae, Hemiptera, cockroaches (*Temnopteryx phalerata* (Sauss)) and *U. insignis*. In this environment both *U. lineatus* and *U. insignis* were observed feeding on cockroaches. Prey capture was not observed here or in the laboratory.

Two pregnant female specimens of *U. insignis* and one of *U. lineatus* were kept in the laboratory. Parturition was observed in both species which behaved similarly. Parturition behaviour was as follows: the scorpion stilted on the two last pairs of legs prior to delivery; the first two pairs were held under the body so that the distal segments were parallel to the body. This posture was maintained throughout parturition. The young began passing through the genital opening head first, one by one into the 'birth basket' formed by the first two pairs of legs. The young became active after a few minutes and began ascending the mother's back by way of her walking legs. When all the young had reached the back they assumed a completely random orientation, sometimes in several layers, which continued to the first moult. This random orientation of first instar young is characteristic of the Buthidae (Williams 1969) (Figs 11–12). With the onset of the second instar stage the litter became distinctly more elongate. Duration of first instar stage of *U. insignis* was 9–12 days with litters of 12 and 13 specimens, and duration of first instar of *U. lineatus* was 11 days with a litter of 8 specimens. Parturition took place from January to February.

KEY TO THE SCORPIONS OF TABLE MOUNTAIN

1. Chelae slender; the dorsal surface not separated by a keel (Family Buthidae). Found in simple runs or scrapes under stones or beneath tree bark 2

– Chelae large, the dorsal surface separated into inner and outer sections by a smooth keel (Family Scorpionidae). Found in burrows, usually opening under stones . . . . *Opisthophthalmus capensis* (Herbst)

2. Species large; stridulatory areas on dorsal surface of caudal segments I and II well developed. Posterior dorsal surface of caudal segment II raised to form a subtriangular lip *Parabuthus capensis* (Ehrenberg)

– Species small; stridulatory areas on cauda absent 3

3. Tergites with short lateral keels and seven black longitudinal lines *Uroplectes variegatus* (Koch)

– Tergites without lateral keels, darkly pigmented 4

4. Tubercle below aculeus distinctly laterally compressed; vesicle yellow . . . . *Uroplectes lineatus* (Koch)

– Tubercle below aculeus conical and blunted; vesicle black *Uroplectes insignis* Pocock

Fig. 11. First instar of *Uroplectes insignis*. Note the random orientation typical of the Buthidae.

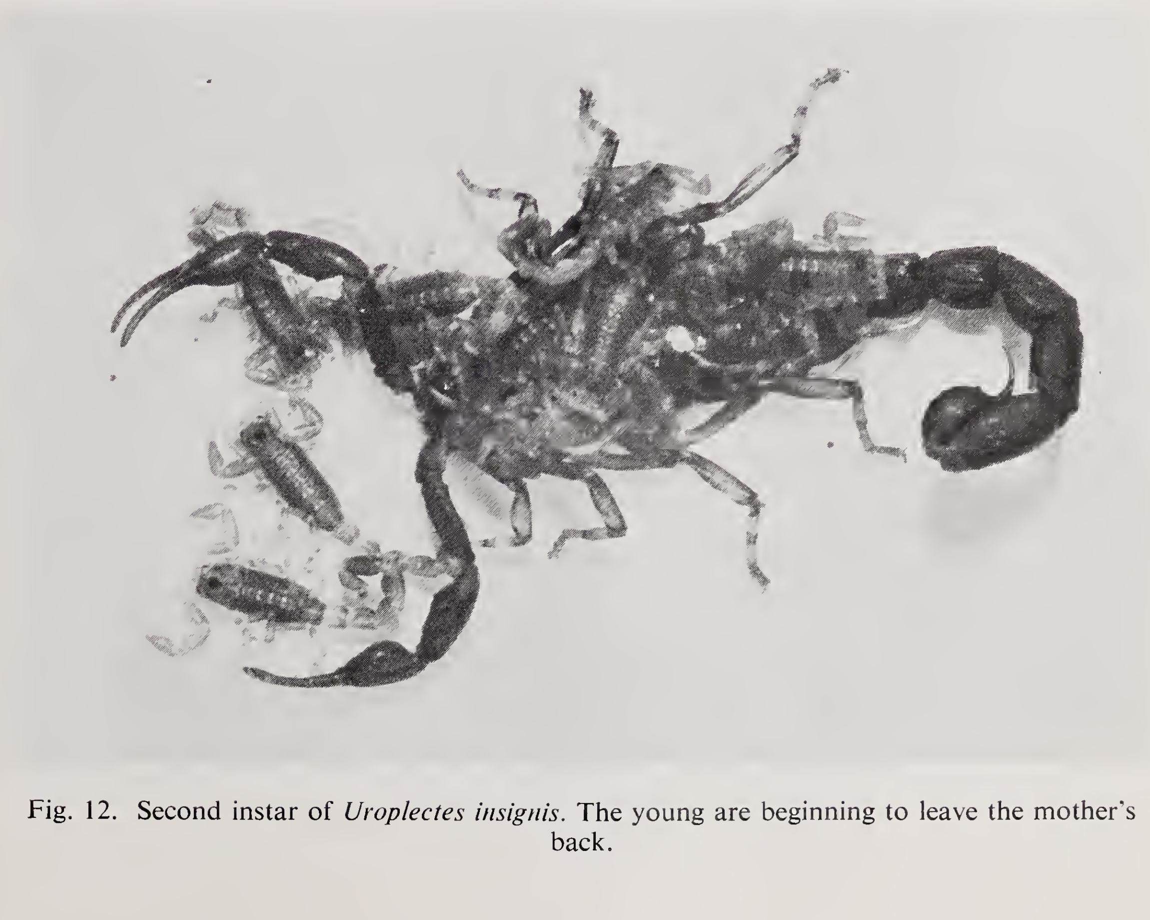

Fig. 12. Second instar of *Uroplectes insignis*. The young are beginning to leave the mother's back.

CONCLUSIONS

Four scorpions species were found on Table Mountain and Signal Hill. Two species, *Opisthophthalmus capensis* and *Uroplectes lineatus*, were very abundant whereas the other two were rare (*U. insignis* and *U. variegatus*). *O. capensis* was abundant on the western north-facing subarea, the greater proportion occurring in the dry proteoid plant community below the 400 m contour. Fewer specimens occurred in the low scrub communities since these areas are very steep and the substratum and ground cover unstable during the rainy season. *U. lineatus* was found to be fairly abundant in all subareas studied and has a random distribution, occurring in varied habitats. *U. variegatus* and *U. lineatus* were found respectively to coexist with *O. capensis*, although these two former species were not found to coexist. The fact that all the young produced by two females of *U. insignis* had the characteristics of this species suggests that it is a true-breeding species which coexists with *U. lineatus*. Apparently isolating mechanisms have been acquired for this example of sympatric association, but what these are, is not quite clear.

The notes on the behaviour make comparison with other species possible. In the burrowing behaviour of *O. capensis* two methods are employed to transport the soil; the first is similar to the behaviour shown by *Protophthalmus holmi* Lawrence (as reported by Newlands (1972)), i.e. the soil is transported rapidly backward in a single movement, and the second is like that of *O. flavescens* Purcell and *O. concinnus* Newlands, i.e. the soil is transported backward by a series of jerks. Observations of laboratory specimens of *O. capensis* revealed that the first method was used in exceptionally dry soil where backward movement was smooth and unimpeded. The second method was employed when the soil was damp and therefore difficult to move, or if the burrow was steep or filled with small stones, twigs or similar obstacles. Thus *O. capensis*, which is pelophilous, exhibits burrowing behaviour similar to psammophilous scorpions in certain conditions. The excavation of a run by *Parabuthus capensis* was described by Eastwood (1977*b*). Part of this process was similar to the behaviour shown by *O. capensis* when obstacles had to be removed, but loose sand was excavated in a manner characteristic to *Parabuthus*. The defensive behaviour of *O. capensis* is the same as the generalized behaviour for *Opisthophthalmus* as discussed by Newlands (1969). The resting posture of *O. capensis* prior to feeding differs from that of vejovid scorpions in the position of the metasoma. In *O. capensis* the metasoma is usually curved forward alongside the body whereas the vejovid scorpions discussed by Hadley & Williams (1968) held the metasoma straight out backwards. Feeding behaviour of *O. capensis* was similar to that observed for *Parabuthus capensis*, except that the latter was more reluctant to attack larger and more active prey.

Birth activities of Neotropical Buthidae were discussed by Williams (1969) and this was found to be similar for *U. insignis* and *U. lineatus*. The first instar young of these two species showed the random orientation on the mother's back which was reported for the genus *Centruroides* (Williams 1969).

Because of the position of Table Mountain, the human impact on its ecology is considerable. Frequent fires cause damage to the floral and faunal ecology. In this study it was observed that in recently burnt areas *O. capensis* was abundant, where *U. lineatus* was more abundant in adjacent unburned areas. It is obvious that *O. capensis* is able to withstand a veld fire because of its ability to burrow, whereas a local deme of *Uroplectes* can be exterminated. The lower slopes of the north-facing and east-facing subareas are covered in plantations of alien forest. In these areas there is very little insect life and consequently few scorpions were found.

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